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Case Report

Femoral anteromedial surface plate augmentation in an osteoporotic unstable femoral neck fracture

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Abstract

The technique of direct reduction with an anterior hip approach and the application of an anteromedial femoral neck plate is an alternative method increasing stability in the treatment of femoral neck fractures in young patients. Here we present the case of applying this method to a 33-year-old young patient with epilepsy and osteoporosis. Satisfactory clinical results were obtained in the short-term follow-up results. This study and literature review can be considered to contribute to the limited literature in this area. Nevertheless, there is a need for further studies in this field with more extensive case series with long-term results.

Keywords

Femur; Neck Fracture; Plate; Unstable Fracture; Osteoporosis; Epilepsy

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Introduction

Hip arthroplasty is generally preferred in the treatment of displaced femoral neck fractures in the elderly. In young patients, osteosynthesis is applied more. Therefore, many different implants are used in the fixation of femoral neck fractures [1]. However, in displaced fractures, the complication rate remains high. Non-union and avascular necrosis are the primary major complications seen in femoral neck fractures [2]. The most significant reasons for complications are not providing good reduction during surgery and insufficient stabilization. When osteosynthesis is not successful, arthroplasty treatment is applied [3]. Previous studies have shown the benefit of the fixation method of cannulated screws combined with anteromedial femoral neck plate augmentation [4]. It has been emphasized in the literature that both intramedullar and extramedullar fixation provided by this method will increase stabilization [5].

However, the literature on this subject is limited. The first aim of this study is to make a literature review on this subject. The case presented here was an epilepsy patient with a Garden type 4 fracture. To the best of our knowledge, this is the first report in the literature of such a case. The second aim of this study is to present outcomes of percutaneous cannulated screw fixation combined with anteromedial femoral neck plate in this patient with a fracture of the femoral neck.

Case Report

The patient and family gave informed consent for the case data to be published. A 33-year old female presented at the Emergency Department with pain in the right hip following a fall during a seizure at home. On AP pelvis radiograph, a transcervical fracture was observed in the right hip (AO 31B2.2, Garden type 4) (Figure 1). From the medical history of the patient, it was seen that for the last 7 years she had been under treatment (valproic acid) for epilepsy which was related to the sequelae of meningitis. The patient was a housewife with limited mobilization within the home and did not smoke or drink alcohol. The clinical characteristics of the case are shown in Table.

The patient was admitted for surgery and four hours later operated. With the patient under general anesthesia in the supine position on a traction table, the modified anterior approach to the hip joint was applied. The first incision was made between the anterior superior iliac spine (ASIS) and the lateral edge of the patella. A 7cm long incision was made starting from 5cm below ASIS. Entry was made from the intermuscular septum between the sartorius and the tensor fascia lata. As the patient was thin, there was no need for release of the rectus femoris. The hip joint capsule was fully exposed, then T-shape capsulotomy was performed. Soft tissue and hematoma were cleaned in the fracture area. The reduction was applied under a comfortable view of the whole fracture line. From the gap 3-5cm distal of the peak point of the lateral T. Major, 3 K-wires were advanced. A reverse triangle configuration was formed with one of the wires from the inferior and two from the superior. Titanium cannulated screws of 6.5mm (16mm thread) were placed over the wires. Superior screws were 70mm in length and inferior screws, 75mm. A washer was also used on the inferior screw. The screw positions were confirmed with fluoroscopy.

The hip was then moved into flexion and abduction. A semi-tubular plate with 4 holes was placed on the anteromedial surface of the femoral neck from the anterior incision. First, the plate was shaped to be compatible with the curve of the femoral neck. The plate was fixed with 3 cortical screws (Figure 1). After the suturing of the joint capsule, bleeding was checked. No drain was placed (Figure 1). The reduction was evaluated as Garden's Alignment Index Grade 1. Passive hip movements and isometric quadriceps exercises were started within the first week postoperatively.

Non-weight-bearing mobilization was permitted after the third day, then after the sixth week, toe-touch weight-bearing mobilization, and after the third month, full weight-bearing. Postoperative examinations of the patient were made at 2 weeks, 6 weeks, then 3, 6, and 12 months. No complications such as reduction loss, non-union, avascular necrosis or infection were observed during the follow-up period. The fracture healing was followed up with direct radiographs postoperatively (Figure 2).

On discharge from hospital, the patient was also started on treatment for osteoporosis and Vitamin D deficiency (ibandronic acid and calcium - vitamin D complex). The laboratory test results are shown in Table 1. No complications were observed during the one-year follow-up period. Clinical outcomes were evaluated using the Harris Hip Score (HHS). HHS >90 was defined as excellent, 80–90 as fair, and <80 as a poor outcome.

Table . Clinical characteristic of patient and laboratory results

PCS-12 (Physical Score)		30.03376
MCS-12 (Mental Score)		31.76878
Harris Hip Score	Preop	72
	Postop	75
Sun Exposure Index (0-32)		12
BMI		17,58
DEXA		
L1-L4 Spine		Z score: -4,6
		T score: -4,7
Femur proximal		Z score: -4,1
		T score: -4,1
25-Hydroxy Vitamin D		8,34 ng/mL
Parathormon		32,7 pg/mL
Alkaline phosphatase		89 U/L
Phosphate		3,68 mg/dL
Calcium		9,50 mg/dL
White blood cell		8,63 U/L
Hemoglobin		10,8 g/dL
Platelets		155 U/L

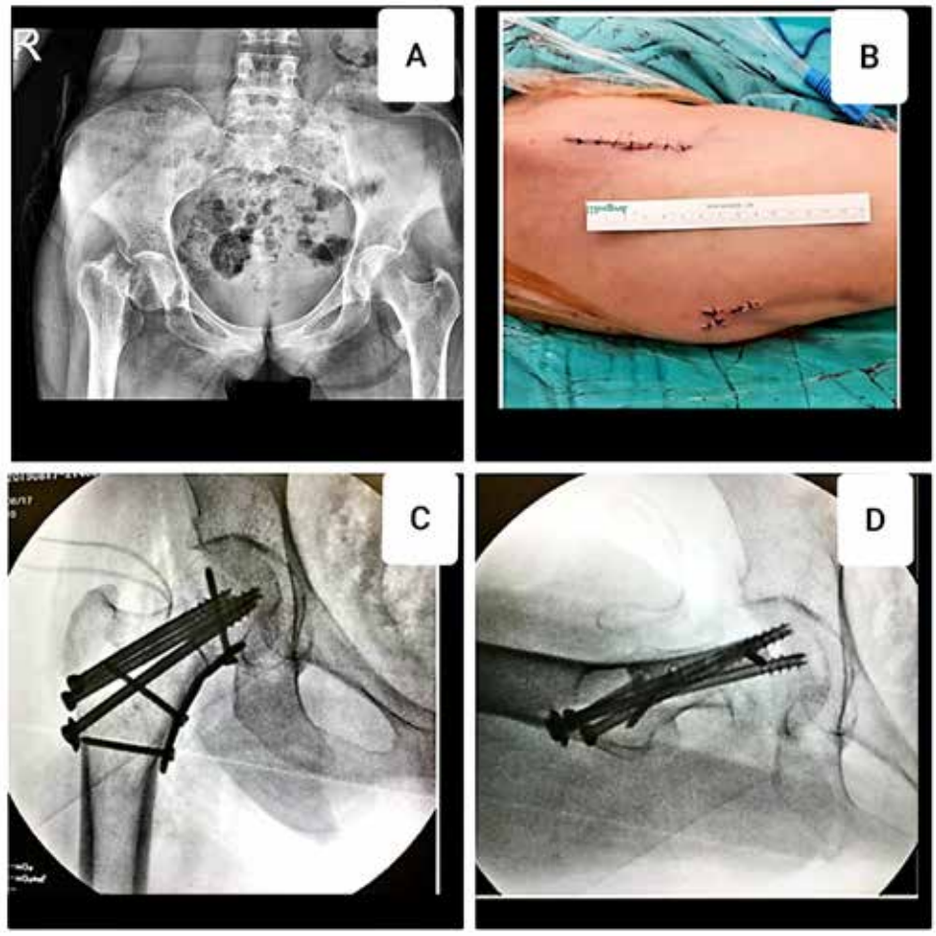

Figure 1. A) Preoperative AP pelvis radiograph. B) Postoperative surgical incisions of the patient. Intraoperative fluoroscopy images of the patient; C) Anteroposterior, D) Figure four position image.

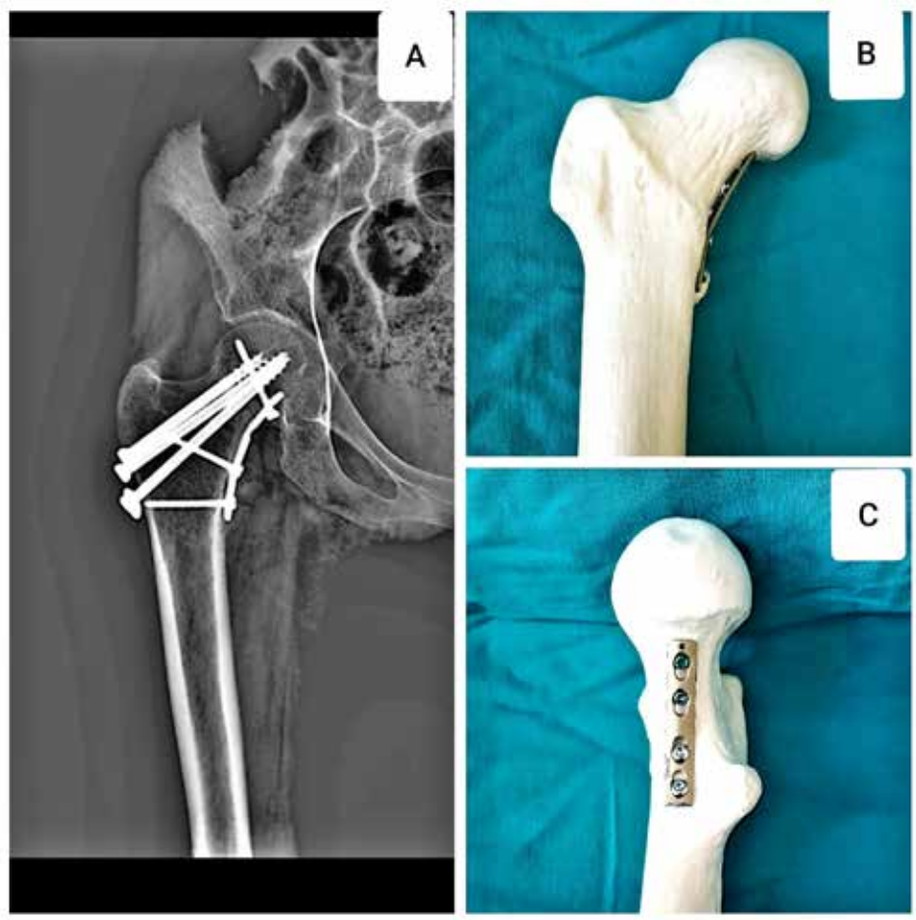

Figure 2. A) Postoperative anteroposterior radiograph showing that union was observed. Semi-tubular plate placed on the femur anteromedial surface of a synthetic bone model; B) Anteroposterior image, C) Inferior image.

Discussion

Rates of non-union and avascular necrosis are still reported as high in unstable femoral neck fractures [6]. As in the case presented here, it is important to protect fixation stability until union is obtained in vertical unstable fracture types. Previous studies have shown the biomechanical superiority of plate augmentation to the anteromedial surface of the femoral neck [7]. In the current case, plate augmentation was applied both because it was an unstable fracture and because of the risk of the patient experiencing another seizure.

The main concern in this treatment approach is injury to the blood circulation of the femoral head. The direct anterior approach to the hip is a widely used approach, in which there is a risk of injury to the lateral femoral circumflex artery (LFCA), but the LFCA makes a limited contribution to the feeding of the femoral head. A large proportion of the feeding of the femoral head is from the medial femoral circumflex artery (MFCA) [7]. With this approach, intracapsular hematomas are drained and reduction can be applied under direct view. Some authors have stated that increased intracapsular pressure because of hematoma creates a risk of avascular necrosis and have therefore emphasized the need for hematoma drainage during the operation [9]. Other published series have emphasized that plate augmentation to the femoral anteromedial surface did not increase the risk of avascular necrosis [5], but there is a need for further studies to support the scarce literature. In the current case, the patient had a low BMI (Body Mass Index) that was an advantage for the surgeon as exposure was easily obtained. Care must be taken that more capsule incisions than necessary are not made. The anterior hip approach and capsulotomy provided the possibility of good reduction with hematoma drainage and direct visualization in the current case. A semi-tubular plate which was thin and easily shaped was used in this case. There are reports in the literature on the use of a reconstruction plate [5]. However, in the selection of the plate, it is important that the plate can be applied in a way that will not cause irritation and impingement in the medial. The function of the plate here is to resist vertical shear stress [7]. The placement of cannulated screws in an appropriate configuration is very important in the stable fixation of a femoral neck fracture. Therefore in the current case, open reduction and cannulated screw fixation were applied. Then plate augmentation was applied to the femoral neck. Placement of the plate too superior and too anterior must be avoided as it is known that this can result in iatrogenic impingement.

In the laboratory test results, Vitamin D deficiency was noticeable. The bone densimetry measurements of the patient were seen to be low. It is also important to present the case with a personal index of sun exposure [10]. In the current case, the physical and mental scores were low. When these were considered together with the limited degree of mobilization, although the patient was 33 years old, the findings mimicked those of an elderly, osteoporotic fracture. This differentiates this case from others in the literature. According to the Harris Hip Scores of the patient, there were poor preoperative and postoperative functional results. Although this shows that the preoperative functional level was regained postoperatively, it is difficult to make a general judgement on the basis of a single case.

This is an elegant looking osteosynthesis. Unfortunately, some authors may have concerns, such as, because of the superiority of DHS, and the risk of compromising the femoral head. They are not wrong in their concerns. Because in the treatment of a femoral neck fracture, the aim of the orthopedic surgeon is to provide blood supply to the femoral head and to regain movement. But this technique, which has limited literature, should always bear in mind. This technique can be considered especially in cases where DHS cannot be used and additional stability is required for cannulated screw fixation.

There is still no consensus in the literature about optimal implant in femoral neck fractures in young patients. Studies comparing three fixation methods such as cannulated screw, DHS with a derotational screw, and proximal femoral locking plate have shown the superiority of DHS [11]. Other studies have demonstrated the superiority of DHS over cannulated screws [12]. However, it is necessary to increase the stability of DHS in osteoporotic and unstable fractures. Locking screws can be used for this purpose [13]. Displacement at the time of first fracture rather than implant selection is the major cause of avascular necrosis [14]. Optimizing stability of femoral neck fracture fixation is important in obtaining a successful outcome [15]. Otherwise, the reoperation rate in femoral neck fractures is around 20% [16]. There is still no consensus for displaced fractures, but DHS is more preferred today [16]. Periodically, trends among surgeons vary [17,18].

Conclusion

The technique of direct reduction with an anterior hip approach and the application of an anteromedial femoral neck plate is an alternative method increasing stability in the treatment of femoral neck fractures in young patients. In this case, we reported this method applied to a patient with epilepsy and osteoporosis. Satisfactory clinical results were obtained in the short-term follow-up results. This case report can be considered to contribute to the limited literature in this area. Nevertheless, there is a need for further studies in this field with more extensive case series with long-term results.

Scientific Responsibility Statement

The authors declare that they are responsible for the article's scientific content including study design, data collection, analysis and interpretation, writing, some of the main line, or all of the preparation and scientific review of the contents and approval of the final version of the article.

Animal and human rights statement

All procedures performed in this study were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards. No animal or human studies were carried out by the authors for this article.

Conflict of interest

None of the authors received any type of financial support that could be considered potential conflict of interest regarding the manuscript or its submission.

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